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SERVICE RECORDS ON TREATED AND UNTREATED WOOD IN THE INTERMOUNTAIN WEST[1/]

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SUMMARY

This is the final report on service tests of fenceposts, poles, pole stubs, and railroad ties, untreated or treated with preservative, conducted either by Forest Utilization Research, or by industry in cooperation with the Forest Service. The earliest test installation was established in 1909, and new tests were added in succeeding years. The service records cover practically all native species of the Intermountain West, four methods of treatment, and eight different preservatives or preservative combinations. Actual or estimated life figures are shown for all test installations.

INTRODUCTION

In the semiarid West (15 inches or less rainfall per year) it has generally been assumed that untreated wood should have a reasonably long service life because decay organisms require moisture to survive. However, studies conducted over the past 50 years indicate the fallacy of this generalization and emphasize the economic value of preservative treating of wood that is to be used in contact with the ground.

Farmers, ranchers, and others often find it expedient to use trees taken from their properties for posts, utility poles, and farm structures. Douglas-fir, western larch, lodgepole pine, western redcedar, ponderosa pine, and cottonwood are the species most commonly used. Without preservative treatment, these species have a relatively short service life; but with

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1/ This paper brings up to date results of experimental studies by the late C. N. Whitney reported in "Results to Date of Studies of the Durability of Native Woods Treated and Untreated," North. Rocky Mountain Forest and Range Expt. Sta., Station Paper 5. 1946.

preservative treatment, their service life may be doubled, tripled, or even quadrupled. Even such naturally durable species as western redcedar benefit from preservative treatment.

The service tests reported on were scattered throughout the State of Montana; however, the results are believed to be applicable to a wide area of the Intermountain West where annual rainfall, ambient temperature, and soil conditions are similar.

GENERAL DESCRIPTION OF THE TESTS

The records in this report were obtained from test installations in various sections of Montana. For many of the installations the number of items shown here is fewer than the number originally installed. Losses have occurred through changing of the lines, road encroachment, fires, mechanical damage, and other causes not associated with decay or insect attack. In such cases the specimens were eliminated from the test.

The service tests have been inspected at various times, usually at regular intervals by Forest Service personnel. Cooperators reported annual replacements or replacements that had to be made between inspections. In these instances, the estimated service life was used in computing the average life.

RESULTS OF TESTS

Service tests must be continued until all or a high percentage of the items have failed in order to obtain actual figures on average life. In arriving at conclusions on the basis of the data presented, two important facts should be considered; namely, (1) that the performance of untreated wood is influenced by the proportion of heartwood and the soil and climatic conditions to which the test items are exposed, and (2) that the performance of wood treated with a preservative is influenced by the thoroughness of the method of application and by the resulting retention and penetration of the preservative.

A review of the test results according to the method of treatment follows:

Groundline treatment.--This diffusion treating process consisted of applying a quantity of Anaconda Wood Preservative (arsenic trioxide) either as dust, granules, or paste, around the pole or post at the groundline, at the bottom of the hole prior to setting, or at both the bottom of the hole and at the groundline. The service life attained with this preservative and treatment was only slightly better than for untreated material. Presumably, this was due to the combination of dry soil and climatic conditions which prevented diffusion of the preservative into the wood. In those areas where rainfall was greater, the treatment produced better results.

Hot-and-cold bath.--The hot-and-cold bath treatment, sometimes referred to as the "open tank" or "thermal process," is one of the more effective of the nonpressure processes; the thoroughness of the treatment obtainable most nearly approaches that of the pressure processes. The treatment consists of heating the wood in a preservative solution in an open tank for several hours, removing the heat source, and allowing the wood and hot solution to cool together. The preservative solution of either coal-tar creosote or tetrachlorophenol and petroleum oil or used crankcase oil proved to be an efficient way of prolonging the life of wood poles and posts.

Pressure treatment.--This preservative method is practical at commercial treating plants only. The process requires that the wood be placed in a closed cylinder or retort, which is then filled with the preservative solution; pressure applied to the solution forces it into the wood. Railroad ties and one post installation were the only materials in these tests treated by this method.

Steeping or cold-soaking.--This preservative method was used with waterborne preservatives and fenceposts. The fenceposts were placed upright in a barrel of zinc chloride or sodium fluoride for several days. During this time the preservative diffused into the wood.

Service test results indicated this procedure to be somewhat better than groundline treatment but not as good as the hot-and-cold bath treating procedure.

Results of the service tests are shown in tables 1 through 4.

Table 1.--Service tests of treated and untreated fenceposts in Montana

Item No.	Species and preservative	Treatment[1]	Average retention of preservative	Form	Location	Installed	Last inspected	Posts tested	Posts removed up to and at time of last inspection[2]		Average life
			Lbs. per cu. ft.						No.	Percent	Years
	Ash, green										
1	Anaconda Wood Preservative (dust)	Groundline	--	Round	Miles City	1926	1941	12	12	100.0	7.3
2	Sodium fluoride	Steeping	0.28	Round	Miles City	1926	1943	19	19	100.0	13.1
3	Zinc chloride	Steeping	.46	Round	Miles City	1926	1943	10	10	100.0	13.1
4	None	Untreated	--	Round	Miles City	1926	1941	12	12	100.0	8.6
	Cottonwood										
5	Anaconda Wood Preservative (dust)	Groundline	--	Round	Miles City	1926	1943	33	33	100.0	9.3
6	Coal-tar, 33.3 percent--used crank-case oil, 66.7 percent	Hot-and-cold bath (butts)	1/3 gal. per post	Split	Lavelle Creek	1934	1957	46	46	100.0	23.7
7	Sodium fluoride	Steeping	.28	Round	Miles City	1926	1943	10	10	100.0	9.4
8	Sodium fluoride	Steeping	.17	Round	Miles City	1926	1941	13	13	100.0	7.8
9	Zinc chloride	Steeping	.67	Round	Miles City	1926	1943	6	6	100.0	13.1
10	Zinc chloride	Steeping	.48	Round	Miles City	1926	1943	19	19	100.0	13.5
11	None	Untreated	--	Round	Miles City	1926	1941	7	7	100.0	6.5
	Douglas-fir										
12	None	Untreated	--	Round	Basin	1928	1935	7	4	57.1	7.0
	Pine, lodgepole										
13	Anaconda Wood Preservative (dust)	Groundline	1.5 lbs. per post	Round	Miles City	1926	1943	13	12	92.3	15.0
14	Creosote, coal-tar	Hot-and-cold bath (butts)	4.7 lbs. per post	Round	Missoula	1916	1957	14	14	100.0	45.0
15	Creosote, coal-tar	Hot-and-cold bath (butts)	3.6 lbs. per post	Split	Missoula	1916	1957	17	17	100.0	43.0
16	Creosote, coal-tar	Pressure	--	Round	Rocker	1915	1931	610	146	24.0	21.0
17	Sodium fluoride	Steeping	.095	Round	Miles City	1926	1943	36	36	100.0	13.5
18	Tetrachlorophenol 3 percent in petroleum oil	Hot-and-cold bath (butts)	--	Round	Squaw Creek	1935	1957	83	8	9.6	36.9
19	Zinc chloride	Steeping	.28	Round	Miles City	1926	1943	17	17	100.0	15.0
20	Zinc chloride	Steeping	.35	Round	Miles City	1926	1943	51	32	62.7	16.0
21	None	Untreated	--	Round	Basin	1928	1935	22	14	63.6	6.0
22	Untreated	Untreated	--	Round	Miles City	1926	1943	20	20	100.0	9.4
23	None	Untreated	--	Round	Missoula	1916	1928	5	5	100.0	11.0
24	None	Untreated	--	Split	Missoula	1916	1926	5	5	96.2	9.4
	Pine, ponderosa										
25	Anaconda Wood Preservative (dust)	Groundline	--	Round	Miles City	1926	1943	33	32	97.0	12.0
26	Anaconda Wood Preservative (dust)	Groundline	--	Split	Miles City	1926	1943	6	6	100.0	15.0
27	Sodium fluoride	Steeping	.25	Round	Miles City	1926	1943	33	32	97.0	12.0
28	Sodium fluoride	Steeping	.24	Round	Miles City	1926	1943	17	17	100.0	9.9
29	Sodium fluoride	Steeping	.27	Split	Miles City	1926	1943	20	20	100.0	15.3
30	Zinc chloride	Steeping	.75	Round	Miles City	1926	1943	6	5	83.3	15.0
31	Zinc chloride	Steeping	.48	Round	Miles City	1926	1943	40	27	67.5	16.0
32	Zinc chloride	Steeping	.49	Split	Miles City	1926	1943	18	18	100.0	15.1
33	None	Untreated	--	Split	Miles City	1926	1943	6	6	100.0	8.3
34	None	Untreated	--	Round	Miles City	1926	1941	23	23	100.0	8.6
35	None	Untreated	--	Round	Moiese	1909	1912	380	380	100.0	3.5
	Redcedar, western										
36	Anaconda Wood Preservative (dust)	Groundline	--	Split	Miles City	1926	1943	50	10	20.0	23.0
37	Creosote, coal-tar	Hot bath (butts)	--	Round and Split	Moiese	1909	1951	8,227	3,064	37.2	48.0
38	Sodium fluoride	Steeping	.14	Split	Miles City	1926	1943	19	10	52.6	18.0
39	Sodium fluoride	Steeping	.11	Split	Miles City	1926	1943	18	1	5.5	--
40	Zinc chloride	Steeping	.34	Split	Miles City	1926	1943	24	9	37.5	20.0
41	Zinc chloride	Steeping	.25	Split	Miles City	1926	1943	24	1	4.2	--
42	None	Untreated	--	Split	Missoula	1916	1939	51	51	100.0	16.4

1/ Full length unless otherwise specified.
2/ All posts removed because of decay.

Table 2.--Service tests of treated and untreated poles in Montana and Idaho

Item No.	Species and preservative	Treatment[1/]	Average retention of preservative	Location	Installed	Last inspected	Poles tested	Poles removed up to and at time of last inspection[2/]		Averag life
								No.	Percent	Years
	Douglas-fir									
1	Anaconda Wood Preservative (granules)	Groundline	5 lbs. per pole	Two Dot Telephone Line, Montana	1927	1934	485	485	100.0	6.1
	Larch, western									
2	Anaconda Wood Preservative (paste)	Groundline	5 lbs. per pole	Seeley Lake to Mt. Henry, Montana	1930	1940	47	5	12.8	13.5
	Pine, lodgepole									
3	Anaconda Wood Preservative (dust)	Groundline	2.5 lbs. per pole	Hebgen Dam to West Yellowstone, Montana	1927	1933	76	76	100.0	5.6
4	Anaconda Wood Preservative (dust)	Groundline	5 lbs. per pole	Helena to Hilgers Landing, Montana	1926	1935	224	--	--	12.5
5	Anaconda Wood Preservative (dust)	Groundline	5 lbs. per pole	Two Dot Telephone Line, Montana	1925	1934	238	238	100.0	7.3
6	Anaconda Wood Preservative (paste)	Groundline	10 lbs. per pole	Missoula to Monture, Montana	1930	1942	14	14	100.0	14.0
7	Anaconda Wood Preservative (paste)	Groundline	5 lbs. per pole	Two Dot Telephone Line, Montana	1925	1934	51	51	100.0	7.8
8	Creosote, coal-tar	Hot-and-cold bath (butts)	1.3 gal. per pole	Dillon to Rattlesnake Creek, Montana	1920	1957	101	14	14.0	50.0+
9	Creosote, coal-tar	Hot-and-cold bath (butts)	0.5-1.0 gal. per pole	Missoula to Seeley Lake, Montana	1915	1926	32	14	43.8	12.0
10	Creosote, coal-tar	Hot-and-cold bath (butts)	4.3 lbs. per cu. ft.	Rocker, Montana	1912	1931	11	8	[3/] 72.7	19.0
11	None	Untreated	--	Two Dot Telephone Line, Montana	1927	1934	94	94	100.0	6.0
	Redcedar, western									
12	Creosote, coal-tar	Hot-and-cold bath (butts)	4.5 gal. per pole	Harlowton to Billings, Montana	1919-20	1945	247	--	--	30.0+
13	None	Untreated	--	Harlowton, Montana to Avery, Idaho	1915-16	1936	29,718	29,718	100.0	17.4

1/ Full length unless otherwise specified.
2/ All poles removed because of decay, except as noted in footnote 3.
3/ Removed for reasons other than decay.

Table 3.--Service tests of treated and untreated pole stubs in Montana

Item No.	Species and preservative	Treatment	Average retention of preservative	Location	Installed	Last inspected	Stubs tested	Stubs removed up to and at time of last inspection 1/		Average life
								No.	Percent	Years
	Pine, lodgepole									
1	Anaconda Wood Preservative (granules)	Groundline	8 lbs. per stub	Gallatin N.F.	1929	1945	18	9	50.0	16.0
2	Anaconda Wood Preservative (granules)	Groundline	6 lbs. per stub	Gallatin N.F.	1929	1945	34	4	11.8	18.0
3	Anaconda Wood Preservative (paste)	Groundline	7.4 lbs. per stub	Gallatin N.F.	1929	1945	100	27	27.0	17.0
4	Creosote, coal-tar	Hot-and-cold bath (butts)	9.8 lbs. per cu. ft.	Choteau to Ear Mountain	1917	1942	432	9	.2	30.0+
5	Creosote, coal-tar	Hot-and-cold bath (butts)	2.5 gal. per stub	Gallatin N.F.	1924	1957	138	0	.0	33.0+
6	Creosote, coal-tar (40 percent creosote; 60 percent gas-oil solution)	Hot-and-cold bath (butts)	1.5 gal. per stub	Gallatin N.F.	1929	1945	50	--	--	--
7	None	Untreated	--	Gallatin N.F.	1929	1944	3	3	100.0	7.1

1/ All pole stubs removed because of decay.

Table 4.--Service tests of treated and untreated railroad crossties in Montana

Item No.	Species and preservative	Treatment	Average retention of preservative	Location	Installed	Last inspected	Crossties tested	Ties removed up to and at time of last inspection 1/		Average life
			Lbs. per cu. ft.					No.	Percent	Years
	Aspen									
1	Creosote, coal-tar 80 percent; refined coal-tar oil 20 percent	Pressure	6.75	Missoula	1910	1945	1	1	100.0	35.0
2	Creosote, coal-tar 80 percent; refined coal-tar oil 20 percent	Pressure	8.00	Lolo	1910	1947	261	110	42.0	35.0
	Douglas-fir									
3	Creosote, coal-tar 80 percent; refined coal-tar oil 20 percent	Pressure	6.75	Missoula	1910	1946	166	147	89.0	35.4
4	Creosote, coal-tar	Pressure	6.2	Thompson Falls	1915	1944	381	381	100.0	23.3
5	Zinc chloride	Pressure	.8	Plains	1907	1932	197	197	100.0	17.5
6	None	Untreated	--	Plains	1907	1916	570	570	100.0	7.6
7	None	Untreated	--	Plains	1907	1916	571	511	100.0	7.7
8	None	Untreated	--	Thompson Falls	1915	1922	50	50	100.0	7.5
	Fir, grand									
9	Creosote, coal-tar 80 percent; refined coal-tar oil 20 percent	Pressure	6.75	Missoula	1910	1946	102	102	100.0	29.7
10	Creosote, coal-tar	Pressure	9.1	Thompson Falls	1915	1944	196	196	100.0	23.0
	Hemlock, western									
11	Creosote, coal-tar 80 percent; refined coal-tar oil 20 percent	Pressure	6.75	Missoula	1910	1946	1,072	1,045	97.0	30.6
	Larch, western									
12	Creosote, coal-tar 80 percent; refined coal-tar oil 20 percent	Pressure	6.75	Missoula	1910	1946	436	423	97.0	33.4
13	Creosote, coal-tar	Pressure	9.0	Thompson Falls	1915	1944	368	368	100.0	23.4
14	Zinc chloride	Pressure	.8	Plains	1907	1932	193	193	100.0	18.6
15	None	Untreated	--	Plains	1907	1916	551	551	100.0	7.3
16	None	Untreated	--	Plains	1907	1916	568	568	100.0	7.4
17	None	Untreated	--	Thompson Falls	1915	1922	50	50	100.0	6.9
	Pine, lodgepole									
18	Creosote, coal-tar	Pressure	8.6	Thompson Falls	1915	1944	190	190	100.0	22.2
	Pine, ponderosa									
19	Creosote, coal-tar 80 percent; refined coal-tar oil 20 percent	Pressure	6.75	Missoula	1910	1945	3	1	33.3	34.0
20	Creosote, coal-tar	Pressure	7.3	Thompson Falls	1915	1944	368	367	99.7	26.0
	Pine, western white									
21	Creosote, coal-tar 80 percent; refined coal-tar oil 20 percent	Pressure	6.75	Missoula	1910	1945	2	2	100.0	30.5
	Spruce, Engelmann									
22	Creosote, coal-tar 80 percent; refined coal-tar oil 20 percent	Pressure	6.75	Missoula	1910	1946	18	18	100.0	25.3

1/ All crossties removed because of decay.